NWS Nashville presents:

Weather 101
Flooding

Presented by: Meteorologist Paige Barr

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01 Flash Flooding Statistics

127 deaths per year

30-year national average of flash flooding-related deaths

Flash flooding is the #2 weather-related killer in the United States

Startling Statistics

1,000

On average, around 1,000 flash floods happen per year in the US.

50% of deaths

A little more than 50% of flash flooding-related deaths occur in vehicles

33 million

Approximately 33 million people globally were affected by flash floods in 2020.

2024 US Flooding Statistics

- 181 people died as a result of flooding in 2024 in the United States
- Of the deaths, 66 of those happened while driving

02 Meteorology of Flooding

What Meteorologists Look For When it Comes to Flash Flooding

Slow winds

Slow winds = rain not blowing around = ponding

Moisture

Sufficient moisture (> 70%) at the low and mid-levels is needed

Slow storm motion

Questions we ask: is there training potential? What forcing is there?

Deep Cloud Layer

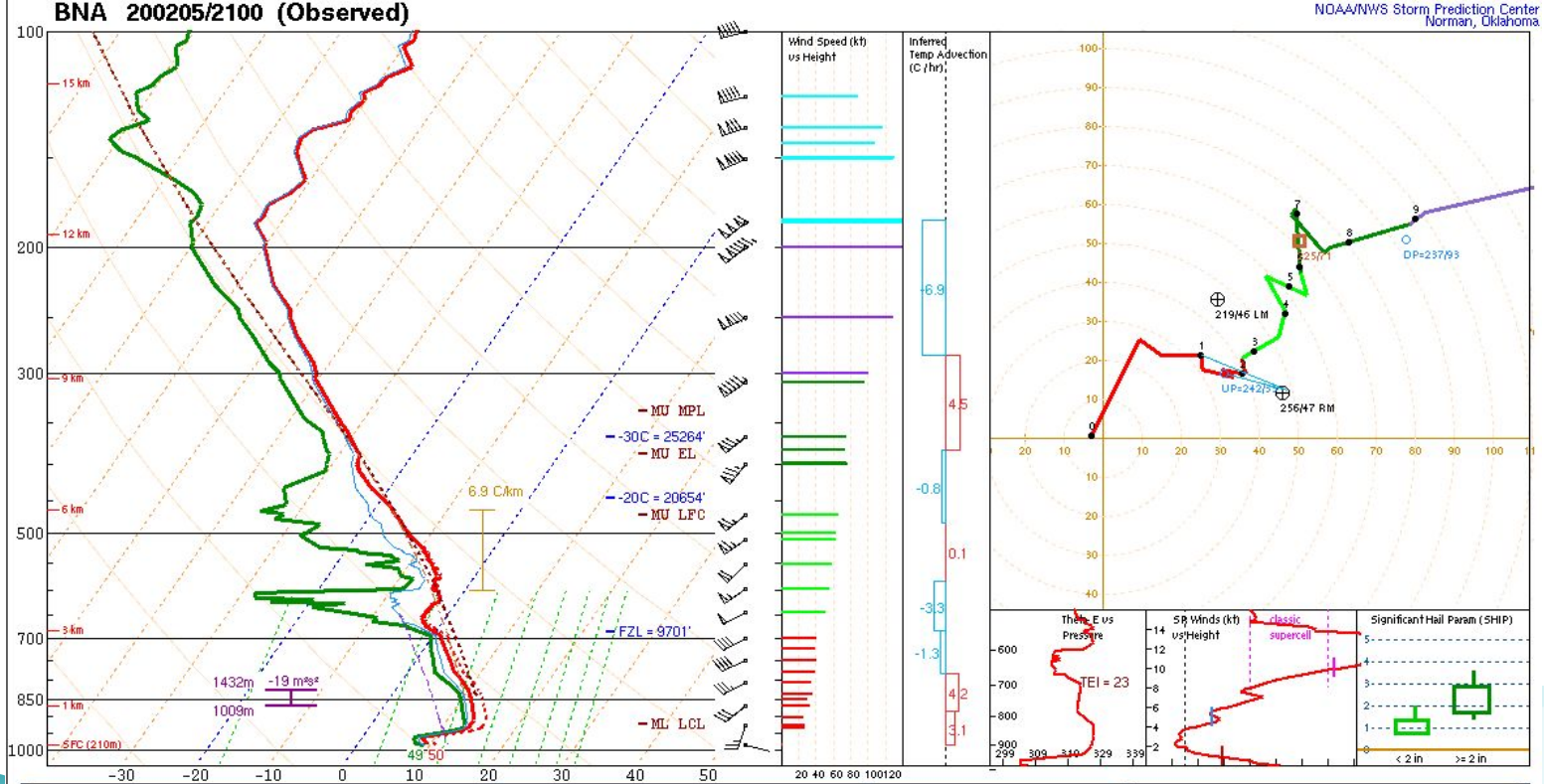
Deep warm clouds hold a lot more precipitation in the form of water

Precipitable Water Values

Greater than the 75th percentile using local climatology

Available Energy

Is there enough energy to generate clouds, thus producing rain?



PARCEL	CAPE	CINH	LCL	LI	LFC	EL
SURFACE	1	0	36m	12	36m	718'
MIXED LAYER	0	0	512m	5	M	1681'
FCST SURFACE	146	-59	1411m	0	5868m	23974'
MU (850 mb)	143	-62	1358m	0	5868m	23974'

PW = 1.14 .in	3CAPE = 2 J/kg	WBZ = 9476'	WNDG = 0.0
K = 33	DCAPE = 435 J/kg	FZL = 9701'	ESP = 0.0
MidRH = 75%	DownT = 55 F	ConvT = 80F	MMP = 0.97
LowRH = 93%	MeanW = 9.1 g/kg	MaxT = 75F	NCAPE = 0.10
SigSevere = 0 m3/s3			

Sfc-3km Agl Lapse Rate =	3.4 C/km
3-6km Agl Lapse Rate =	5.6 C/km
850-500mb Lapse Rate =	5.7 C/km
700-500mb Lapse Rate =	5.5 C/km

Supercell = -0.0
Left Supercell = -0.1
STP (eff layer) = 0.0
STP (fix layer) = 0.0
Sig Hail = 0.0

	SRH(m2/s2)	Shear(kt)	MnWind	SRW
SFC - 1 km	292	35	209/20	98/39
SFC - 3 km	302	47	233/29	101/26
Eff Inflow Layer	-19	9	238/34	106/20
SFC - 6 km	69	233/38		118/20
SFC - 8 km	82	232/41		128/20
LCL - EL (Cloud Layer)	13	186/9		85/47
Eff Shear (EBWD)	24	240/42		127/14

BRN Shear = 97 m²/s²
4-6km SR Wind = 180/26 kt

.....Storm Motion Vectors.....
Bunkers Right = 256/47 kt
Bunkers Left = 219/46 kt

Corfidi Downshear = 237/93 kt
Corfidi Upshear = 242/35 kt

1km & 6km AGL Wind Barbs

*** BEST GUESS PRECIP TYPE ***
Rain.
Based on sfc temperature of 49.6 F.

SARS - Sounding Analogs

SUPERCELL	SGFNT HAIL
No Quality Matches	No Quality Matches

SARS: 0% SIG

Effective-Layer STP (with CIN)

Prob EF2+ Torn with supercell
Sounding CLIMO = .15 sigtor

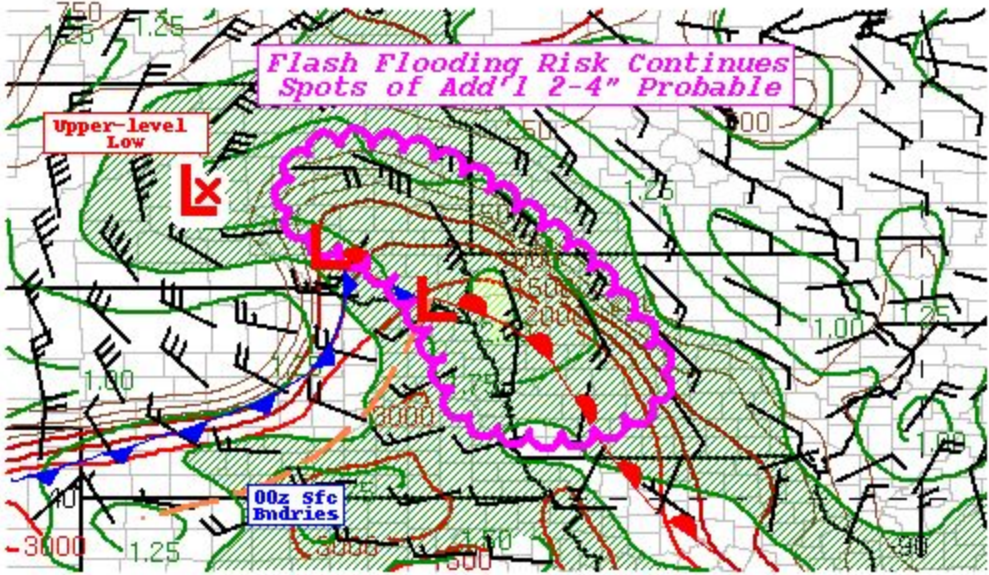
based on MLCAPE:	0.00
based on MLLCL:	0.19
based on ESRH:	0.06
based on EBWD:	0.05
based on STP_fixed:	0.05
based on STP_effective:	0.06

EF4+ EF3 EF2 EF1 EF0 NONTOR

Flash Flooding Ingredients

Key elements to look for:

- High precipitable water values
- High relative humidity
- Moisture influx
- Convergence of winds
- Boundaries (fronts), particularly stationary boundaries
- Wind speed and direction aloft and near the surface



RAP32 MU CAPE 230805/2300f003
RAP32 PRECIP WATER 230805/2300f003
RAP32 850 MB WINDS 230805/2300f003
WPC MPD #0875

Know your Environment

Questions we ask ourselves...

- Has it been raining a lot over the area of interest recently?
- What are the soil conditions like?
- Topography...Is it hilly, flat, mountainous?
- Is in an urban area where flooding can happen faster?

The Steps We Take

- Figure out the threat
- Familiarize yourself with the environment
- Monitor the threat
- Issue watch
- Issue warning
- Follow-up warnings as often as needed depending on how the threat evolves.

03 Types of Flooding

Types of Flooding

River Flooding

- Takes longer to occur
- Typically have time to prepare and evacuate if needed
- Different sources of river flooding: persistent rain for a long period of time, melting snow, or an ice jam

Flash Flooding

- Happens quickly as water rapidly rises
- Occurs generally in a matter of minutes to 6 hours or less during heavy rainfall
- **2 big factors:** *rainfall duration* and *rainfall intensity*

Storm Surge

- An abnormal rise in water level along the coast.
- Generally caused by forces generated from a severe storm's wind, low pressure, and waves i.e. hurricanes

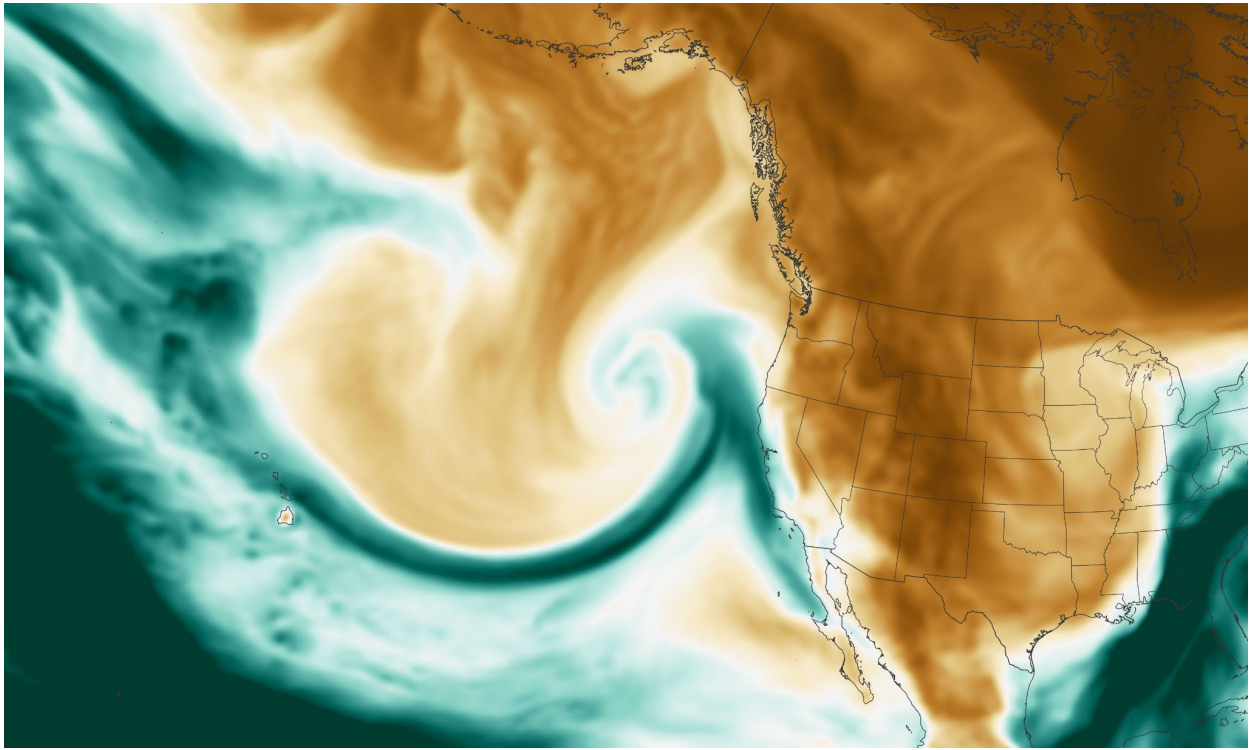
Coastal Flooding

- Inundation of land along the coast caused by high tide

Atmospheric Rivers - NOT a type of Flooding

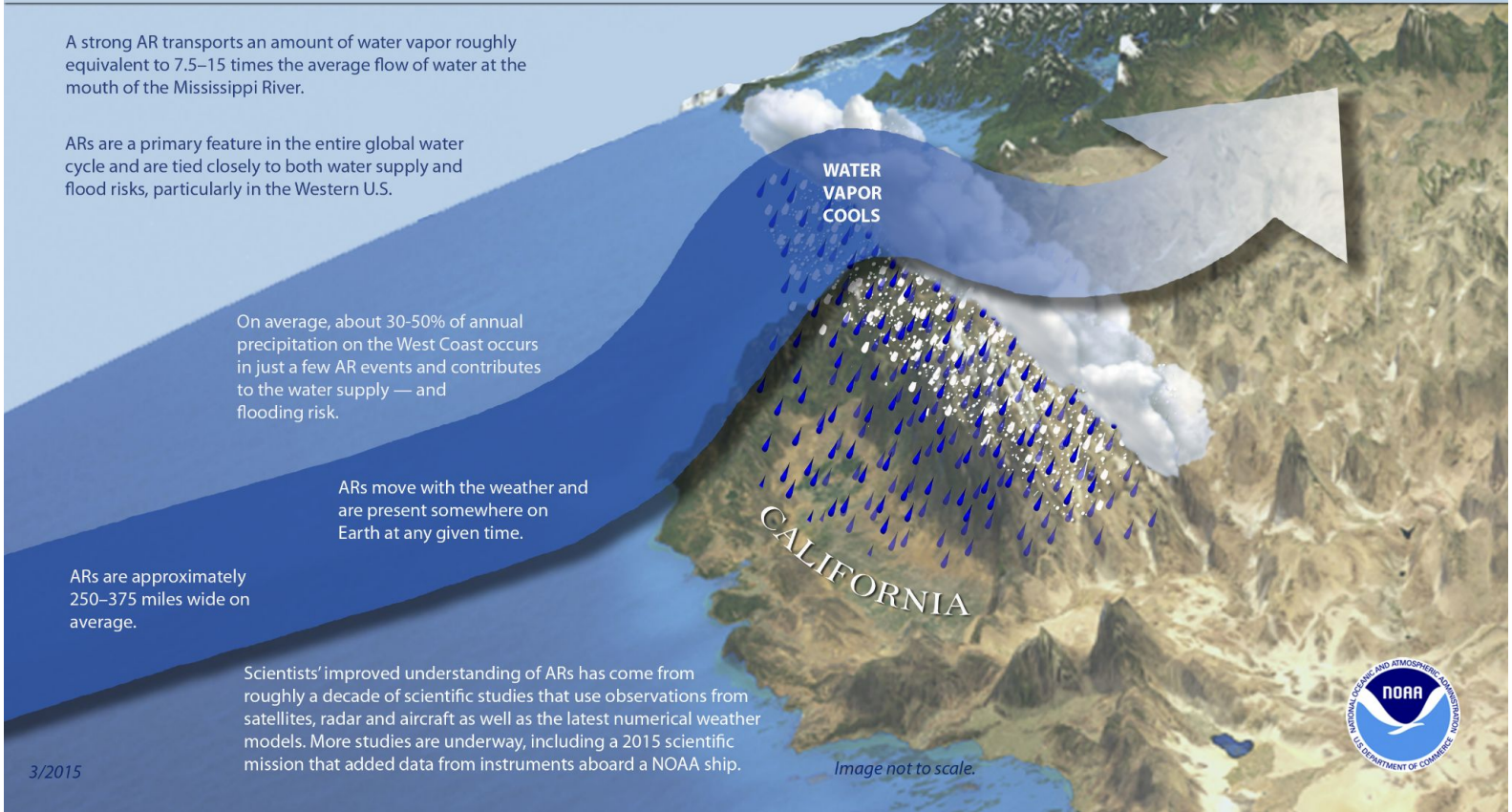
Atmospheric Rivers

- Long, narrow regions in the atmosphere that transport large amounts of water vapor outside of the tropics. i.e. California
- Not all atmospheric rivers cause damage. Some provide beneficial rain or snowpack to an area in need.



The science behind atmospheric rivers

An atmospheric river (AR) is a flowing column of condensed water vapor in the atmosphere responsible for producing significant levels of rain and snow, especially in the Western United States. When ARs move inland and sweep over the mountains, the water vapor rises and cools to create heavy precipitation. Though many ARs are weak systems that simply provide beneficial rain or snow, some of the larger, more powerful ARs can create extreme rainfall and floods capable of disrupting travel, inducing mudslides and causing catastrophic damage to life and property. Visit www.research.noaa.gov to learn more.



Overflowing River

Numerous things can cause a river to overflow. A few are: persistent rain for a long period of time, melting snow, or an ice jam

Ice Jam- occurs when ice clumps together to block the flow of the river.

Nashville, May 2010

Photo credits: Micca Campbell

Dam Break

- Dam breaks are often considered flash flooding due to the sudden nature of the break.
- Causes can be accumulation of melted snow, landslides, severe storms dumping large amounts of rain, jams caused by debris, etc.

Dam failure in Putnam County, Tennessee in April 2020

Flash Flooding

- The fastest and most dangerous type of flooding.
- Can happen in a matter of minutes
- Very little time to prepare
- **MOVE TO HIGHER GROUND!**
- **Do NOT drive through flood waters!!!**

Storm Surge

- Common along coastal areas
- Storm surge is an abnormal rise in sea level during a storm.
- Storm surge is high during storms like hurricanes.
- Coastal flooding can occur due to high storm surge.

04

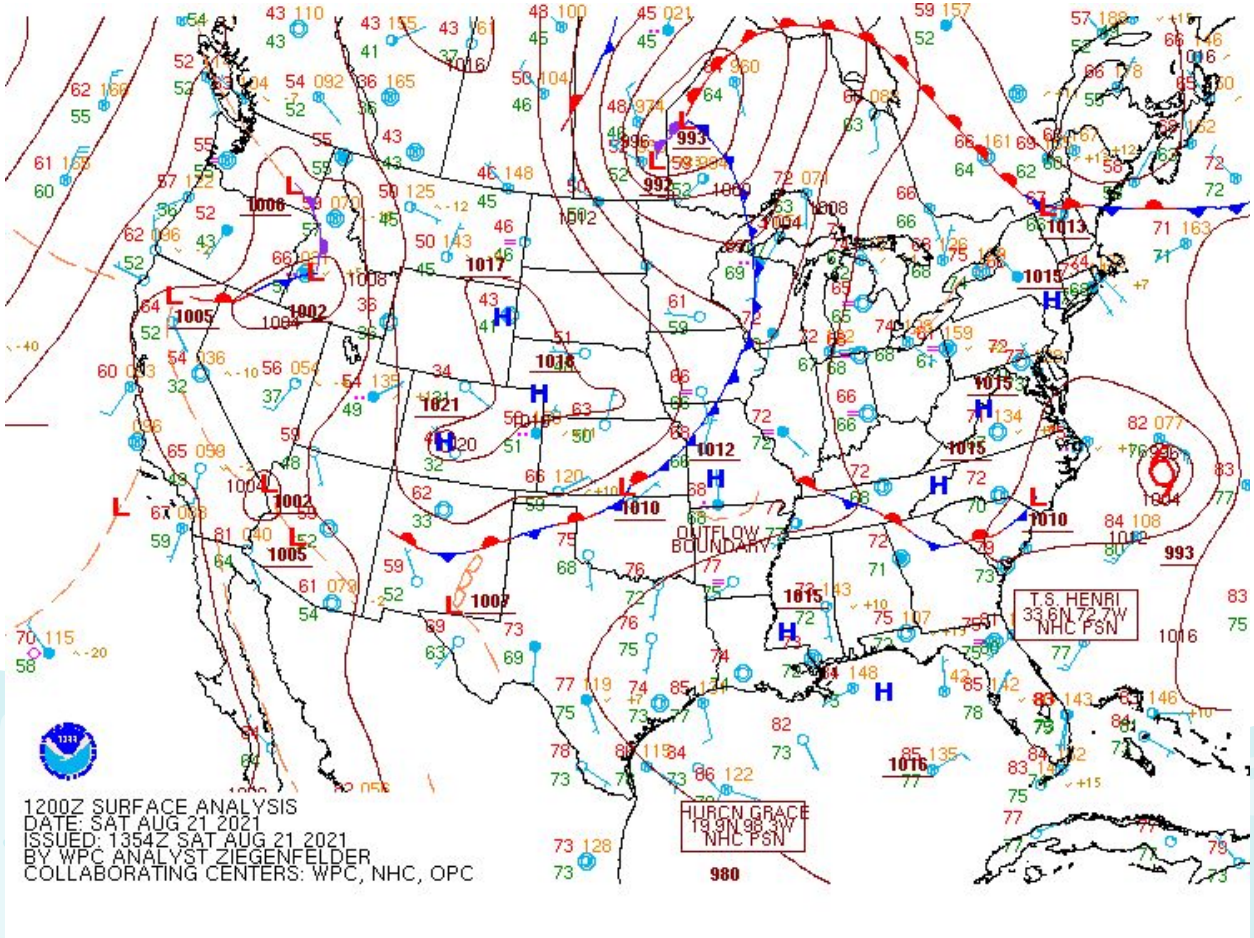
Case Study

Case Study - August 21, 2021 Waverly, TN

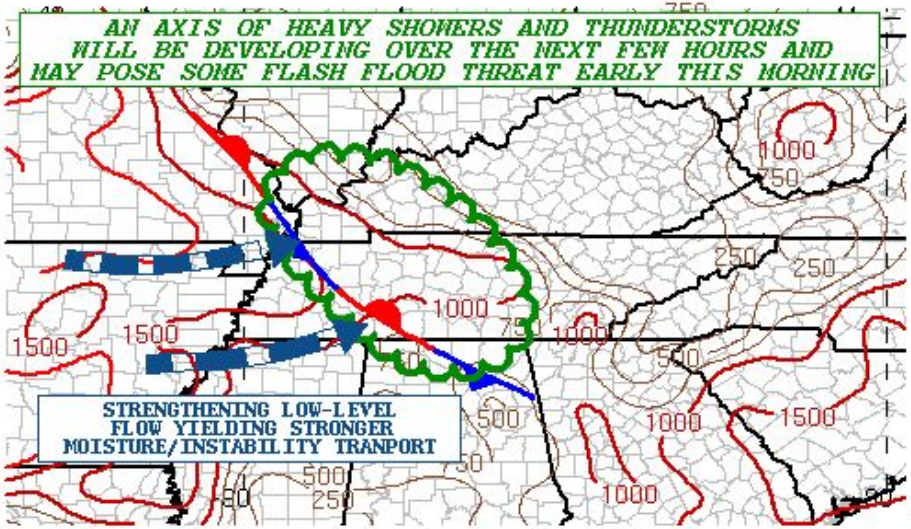
- A stalled stationary boundary draped across the area provided a focus for training rain and thunderstorms. A modest low low-level jet was in place, providing an infusion of moisture into the area.

- Hours of rainfall + periods of intense rainfall are some of the factors that led to this catastrophic flooding event.

12Z Surface Chart



Weather Prediction Center Discussion
2:20 AM 8/21/21



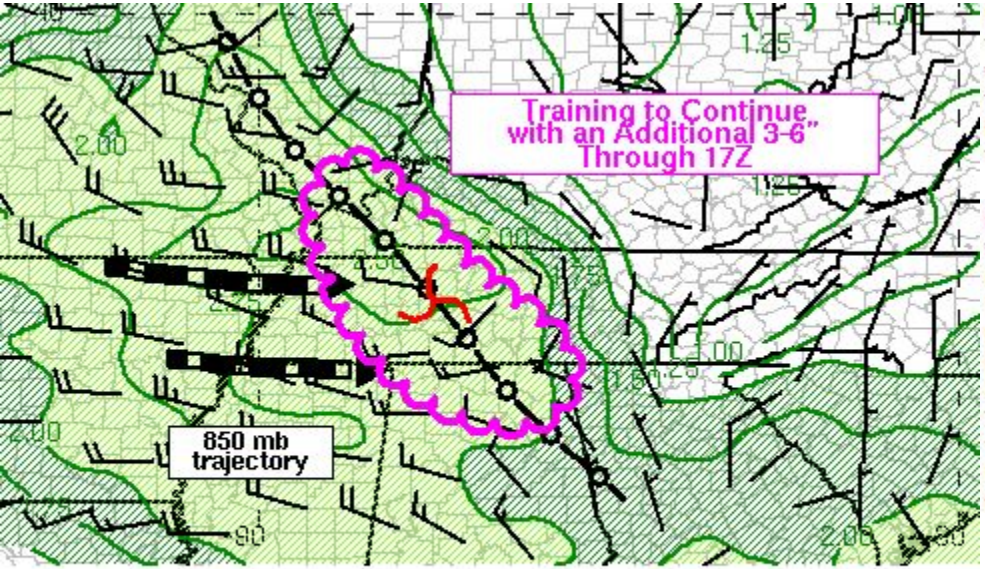
RAP32 ML CAPE (lowest 90MB) j/kg 210821/0500f000
WPC MPD #0847

SUMMARY...An axis of heavy showers and thunderstorms is expected to develop over the next few hours. Some localized repeating of cells may result in some potential for areas of flash flooding early this morning.

There is an elevated stationary front showing up in the 850/925 mb layer across this region and this boundary is expected to become a focus for an expanding axis of heavy showers and gradually a few thunderstorms over the next few hours. Facilitating this will be the arrival of a strengthening westerly low-level jet upstream from portions of the lower/middle MS Valley region. This low-level jet energy will will drive an increase in warm-air advection/isentropic ascent along with deeper moisture and instability transport in an elevated fashion over the aforementioned front.

PWs of 2.0 to 2.3 inches are pooled along and just southwest of the boundary and will certainly favor efficient warm rain processes for enhanced rainfall rates that may locally approach or exceed 2 inches/hour.

Weather Prediction Center Discussion
8:27 AM 8/21/21



RAP32 PRECIP WATER 210821/1100f001
RAP32 850 MB WINDS 210821/1100f000
WPC MPD #0848

SUMMARY...An axis of heavy thunderstorms will likely continue to train for at least another 2-4 hours across western KY into west-central TN. Propagation into northern AL is expected later in the morning. Flash flooding, which may be fairly significant, is expected to continue from additional rainfall totals of 3-6 inches through 17Z.

DISCUSSION...Regional radar imagery at 12Z showed a 10-20 mile wide axis of training thunderstorms extending from far southeastern IL into west-central TN. Peak rainfall rates through 12Z were averaging 2.0 to 3.5 inches per hour with reports as high as 7 inches in 3 hours across southwestern Dickson County ending at 1130Z. The axis of thunderstorms seemed to be aligned with a low level axis of convergence which showed up well in the surface to 850 mb layer of the CIRA Layered PW product. Storms were forming along the convergence axis with mean movement toward the southeast, following quasi-parallel to the orientation of upwind Corfidi vectors.

12Z BNA Sounding

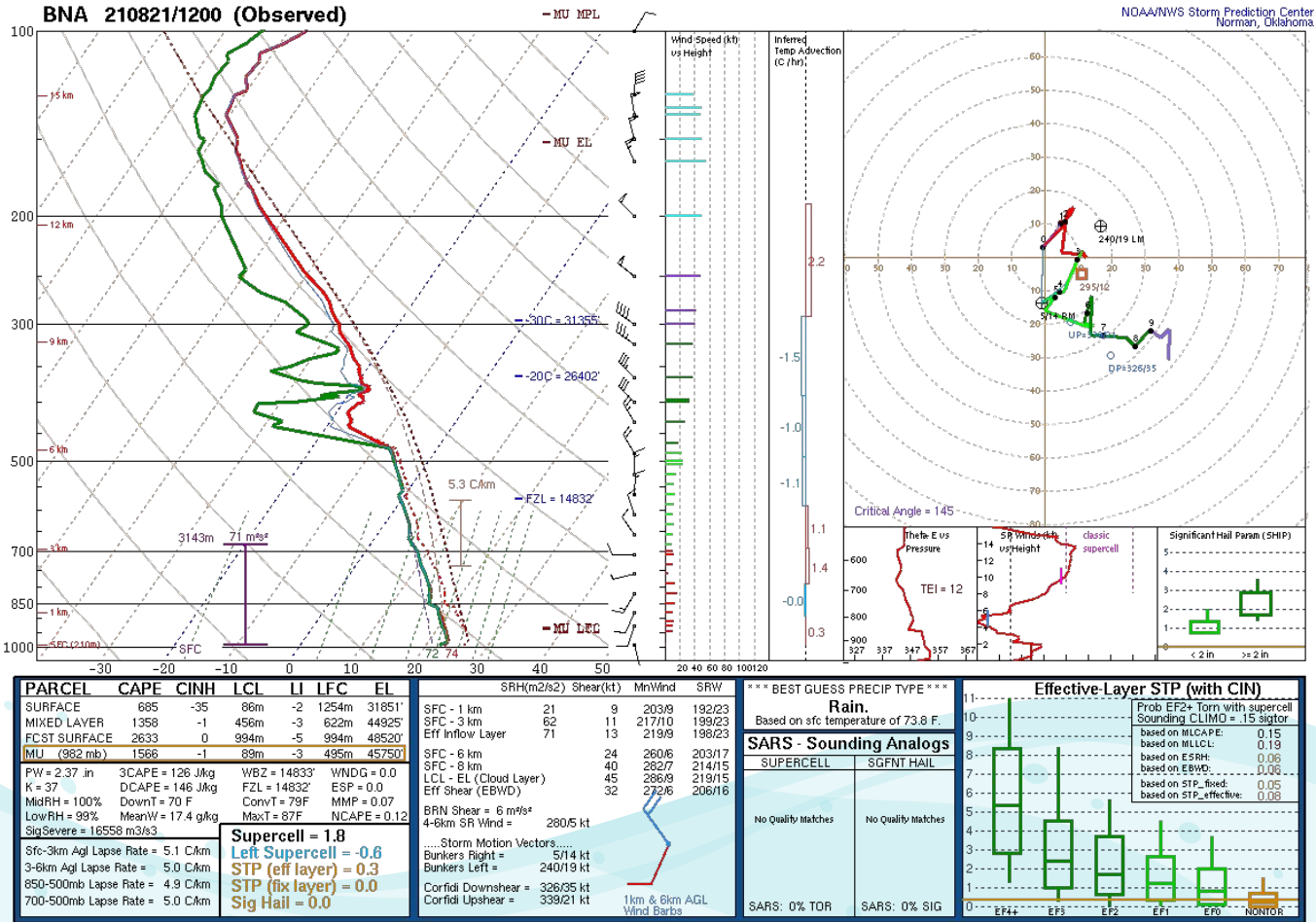
Moisture: ✔

Deep Cloud Layer: ✔

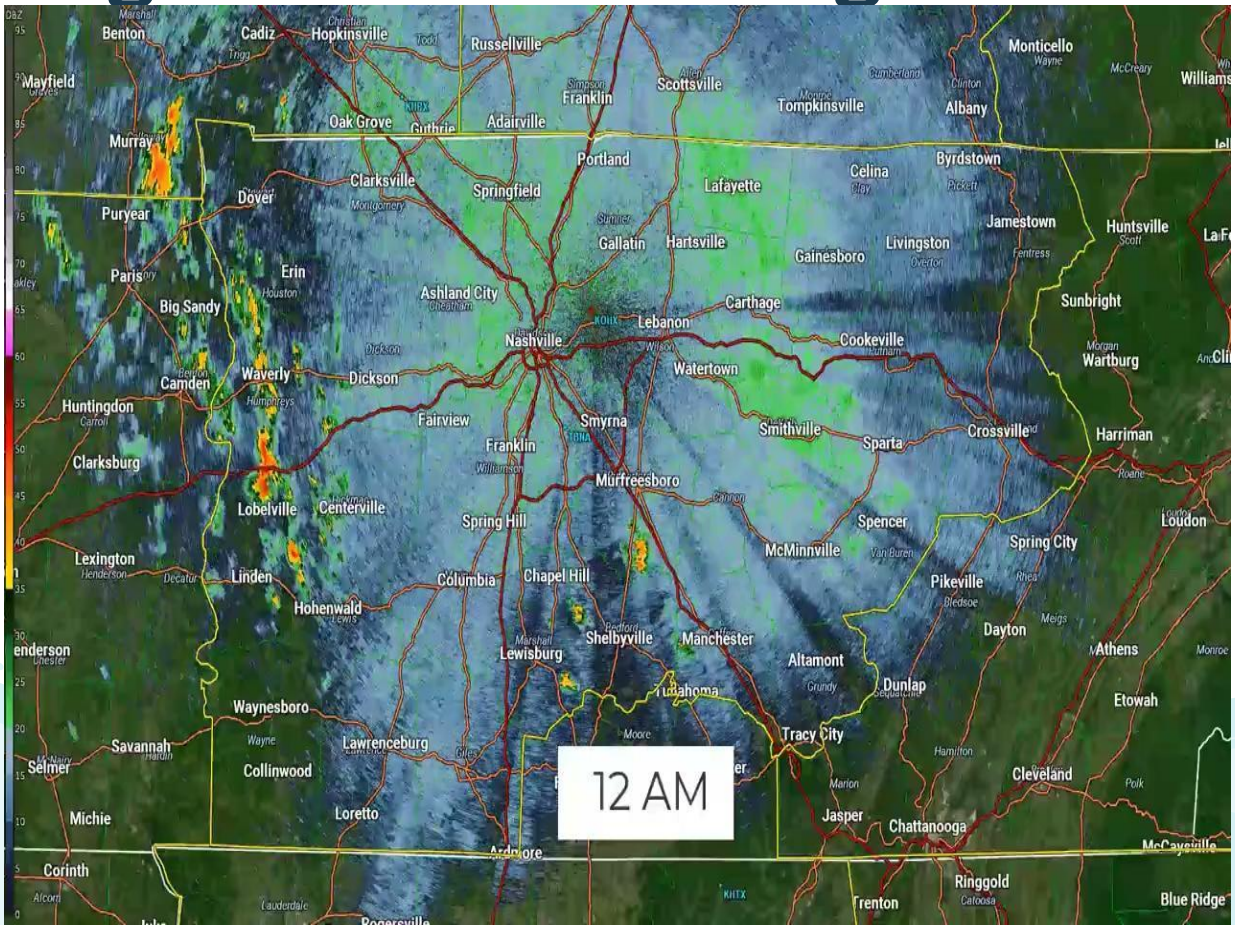
PWAT: ✔

Energy (CAPE): ✔

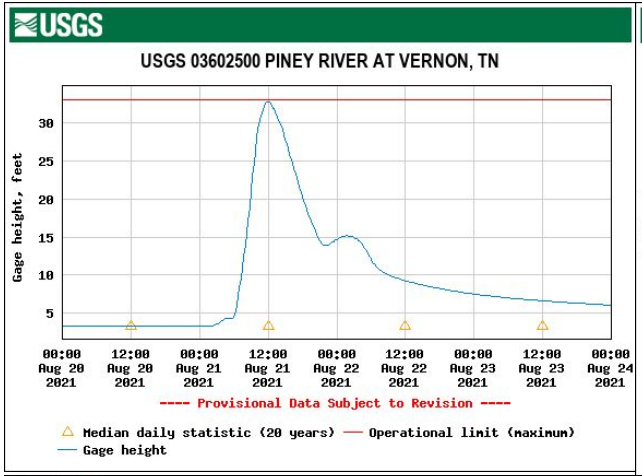
Slow Storm Motion: ✔

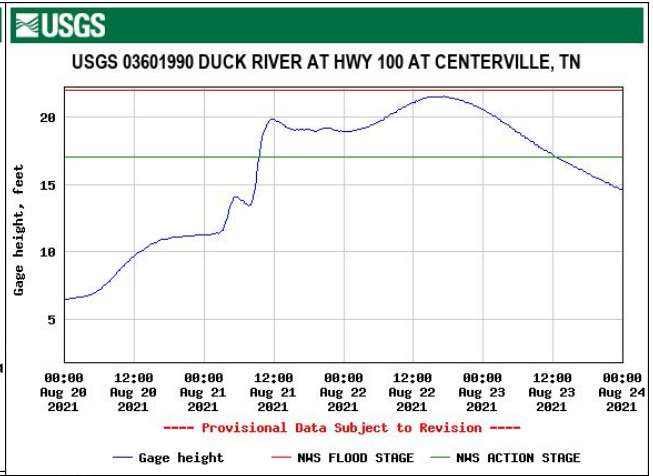


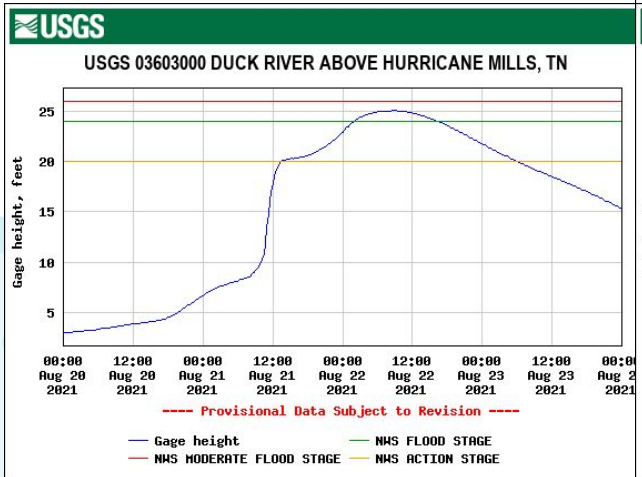
Radar Imagery
August 21 12 AM through 11 PM

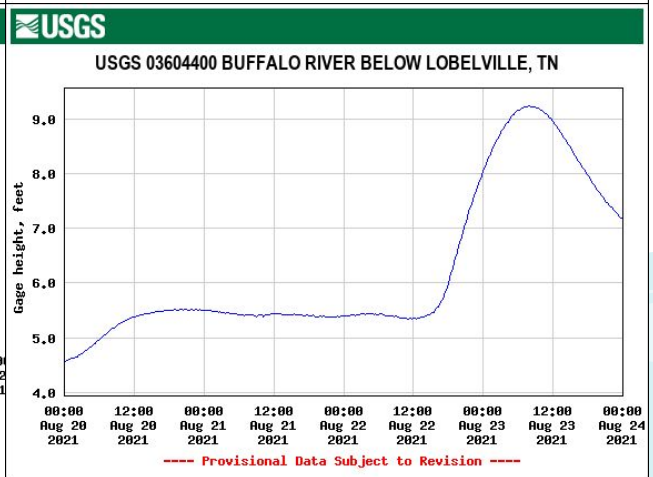


River Gauges

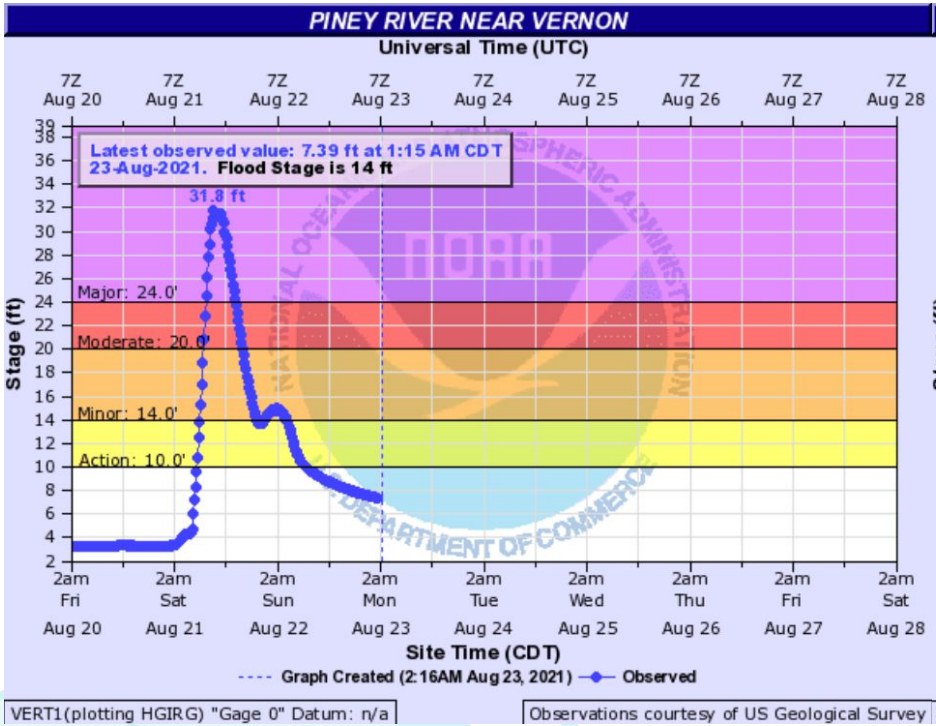


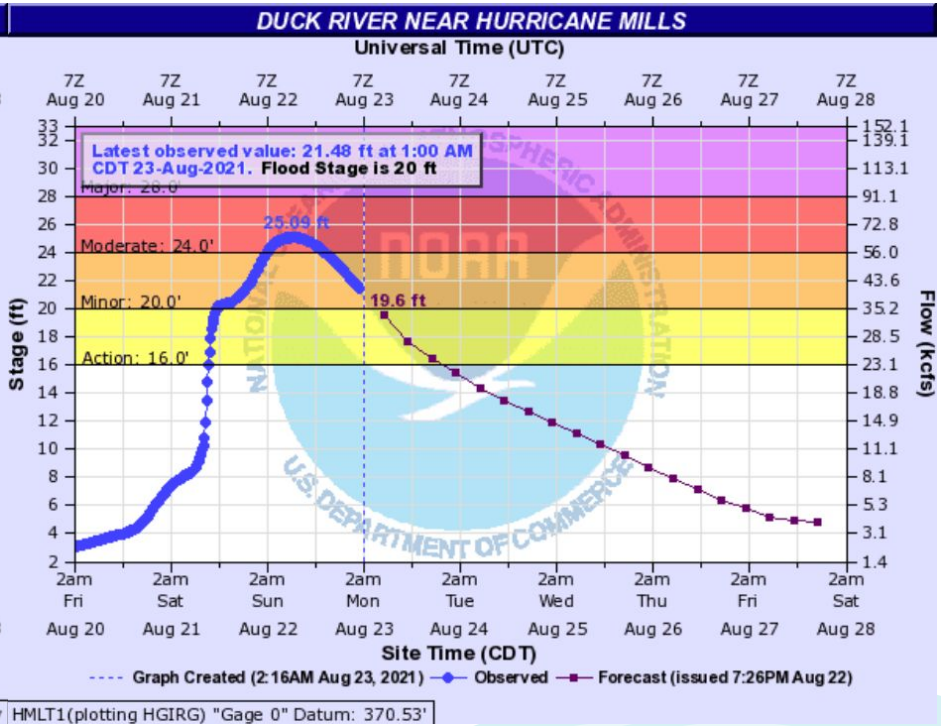






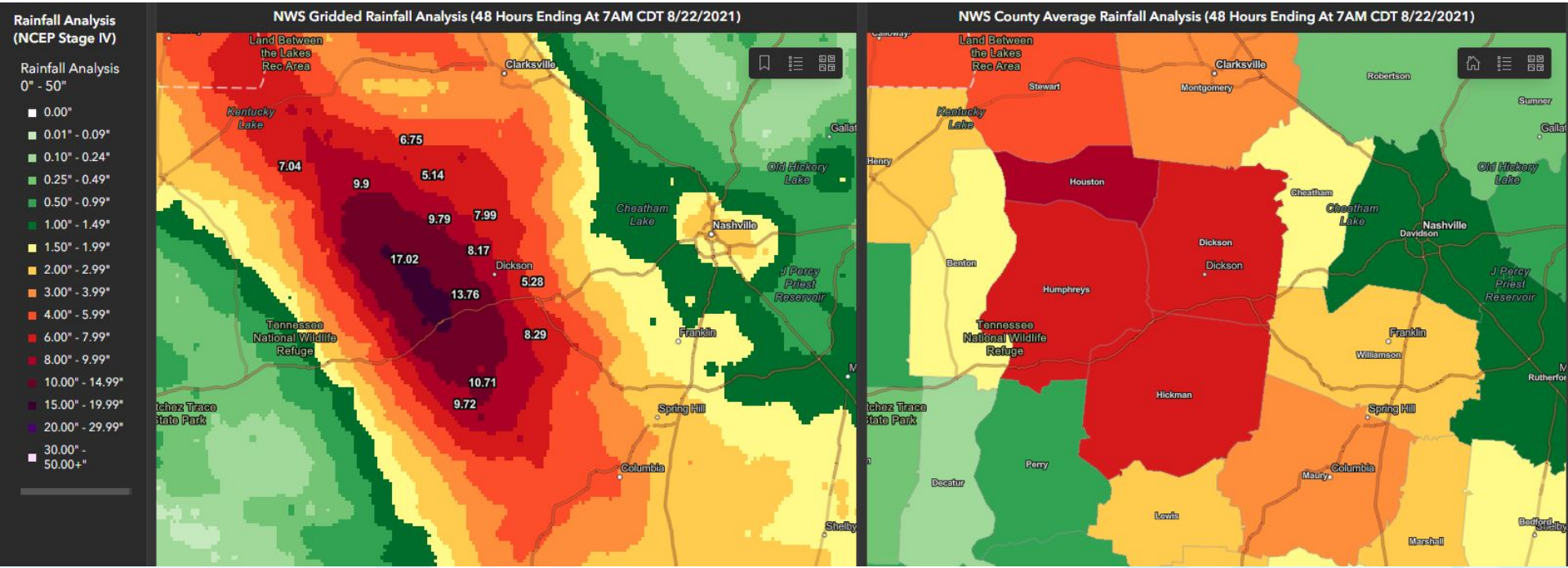
AHPS Hydrographs





Observations courtesy of US Geological Survey

48-Hour Rainfall Totals



So what ended up happening?

As you saw on the radar loop, training thunderstorms over west middle TN resulted in catastrophic flash flooding.

Rain started just before 1 AM. With already 1.5-2.5 inches fallen in the first hour, the first **Flash Flood Warning** was issued at 3:39 AM.

Heavy rain continued due to training thunderstorms and emergency management reported life-threatening flash flooding.

This led to the rare issuance of a **Flash Flood Emergency** at 7:47 AM.

The first reports of catastrophic flash flooding in Waverly started coming in at 10:01 AM. Some accounts say the water rose 5 to 6 ft in under 5 minutes.

Waverly Flood Story Map

https://storymaps.arcgis.com/stories/13b68e35b8fd48e0b0188f1645992b98

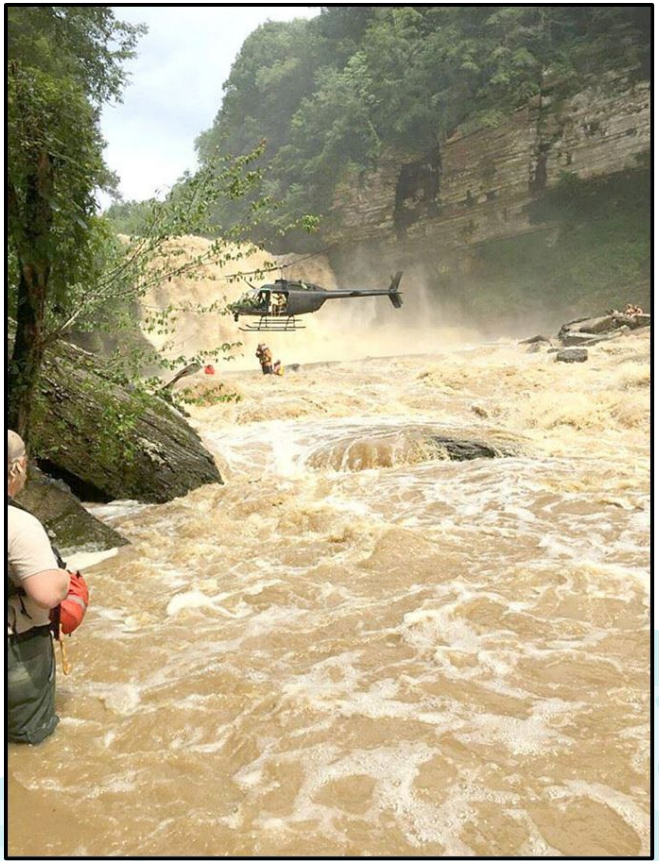
Wrap up of Case #1

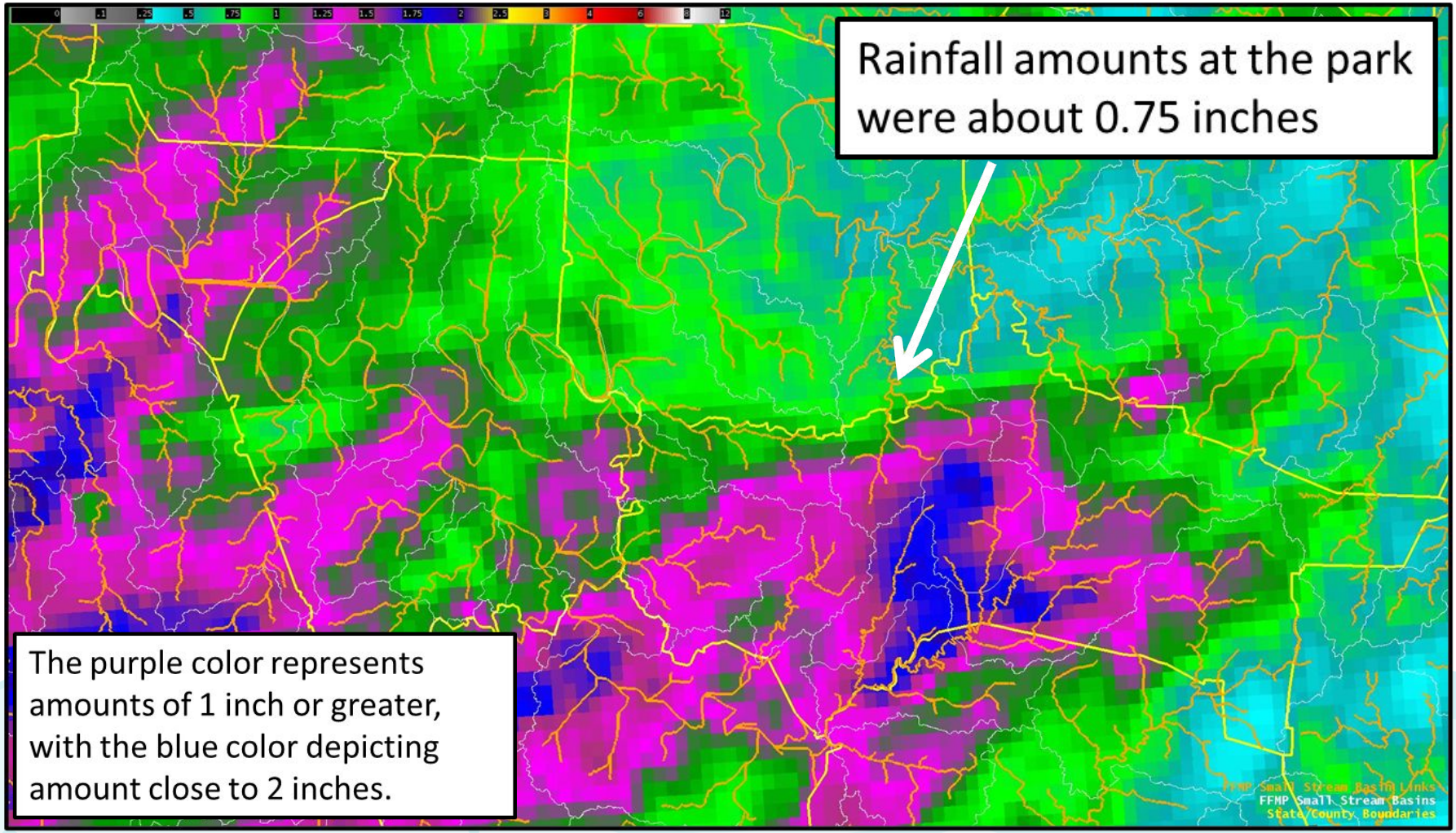
- Training storms can dump a lot of rainfall over an extended period of time
- With that, high rainfall amounts are possible even if the rainfall intensity is low.
- Overnight cases of this can be especially dangerous.

Case Study #2 - Cummins Falls State Park Cookeville, TN. July 5, 2017

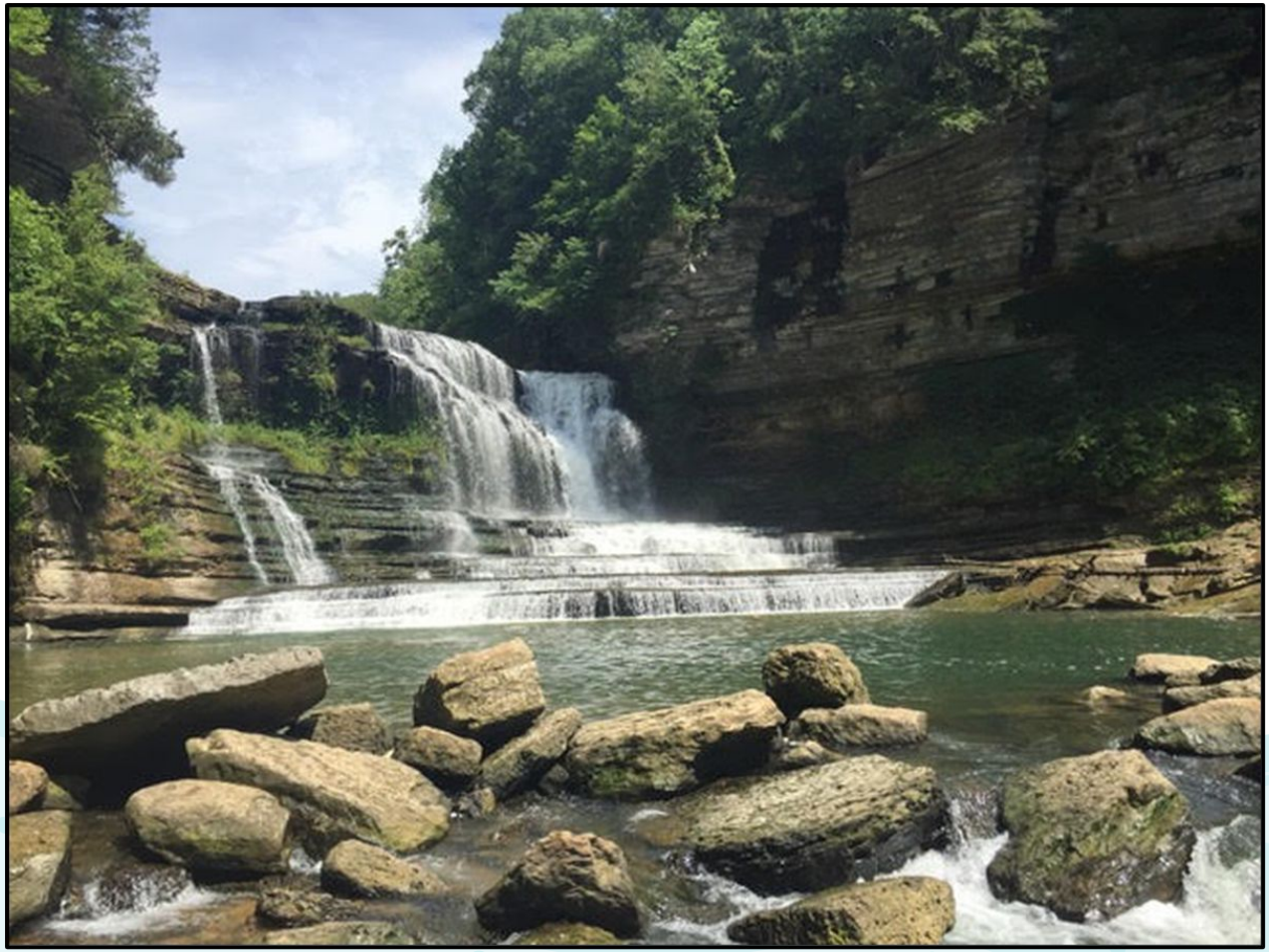
Cummins Falls State Park
Cookeville, TN.

- A line of strong thunderstorms moved across the area the afternoon of July 5.
- On the days leading up to this, there had been multiple days of rainfall, so the area was primed for flash flooding.
- Multiple water rescues happened and unfortunately, 2 fatalities occurred.




Rainfall amounts at the park were about 0.75 inches
The purple color represents amounts of 1 inch or greater, with the blue color depicting amount close to 2 inches.
FFMP Small Stream Basin Links
FFMP Small Stream Basins
State/County Boundaries

3:49 pm



3:51 pm

3:52 pm

3:54 pm

3:55 pm

4:30 pm

Wrap up Case #2

- The rainfall intensity was high in this situation
- A lot of rain fell in a short period of time
- Antecedent conditions were also moist due to several rounds of rain in previous days

05
NWS Flood Products

Flood Watch

Flood Watch means
be prepared:
Flooding is possible

- ☑ Check for forecast updates
- ☑ Prepare to move to higher ground
- ☑ Stay weather ready

weather.gov/flood

Flash Flood Warning

NWS Products

- Middle TN Hazardous Weather Report
- Flood Potential Outlooks (ESF)
- Flood/Flash Flood Watches (FFA)
- Flood/Flash Flood Warnings (FFW)

–Dam Break – Downstream will be a Flash Flood Warning

- Flood Statements (FLS)
- Flood Advisories (FAY)
- Urban and Small Stream (FAY)

Hydrologic Outlook

FGUS74 KOHX 272034
ESFOHX
TNZ005>011-023>034-056>066-075-077>080-093>095-281100-

Hydrologic Outlook
National Weather Service Nashville TN
334 PM CDT Sun May 27 2018

...Remnants of Subtropical Storm Alberto to Soak the Mid-State Tuesday and Wednesday...

The remnants of Subtropical Storm Alberto will move across Middle Tennessee Tuesday and Wednesday, and bring along some heavy downpours. Since the low pressure center is still expected to track close to Interstate 65, it looks like the heaviest rainfall will occur over western sections of the Mid-State, generally between Interstate 65 and the Tennessee River. This includes areas around Nashville, Clarksville, Dickson, Columbia and Waynesboro.

Between two and three inches of rain are likely to fall over western Middle Tennessee Tuesday and Wednesday, with locally higher amounts to around four inches.

Training of heavy showers will be likely, especially Tuesday afternoon and Tuesday night, and this will produce the possibility of localized flooding. In addition, heavy rain amounts will cause some creeks and streams in the Mid-State to run near bankfull. Right now it looks like the heaviest rains will occur over western Middle Tennessee. However, if the track of the low pressure system shifts further to the east, the area of heaviest rains will shift eastward as well.

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Flood/Flash Flood Watch

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FFAOHX

Flood Watch
National Weather Service Nashville TN
355 PM CDT Tue May 29 2018

...Periods of Heavy Rainfall Are Expected Today into Tonight
Across Middle Tennessee...

.Subtropical Depression Alberto is expected to approach and move
across mid state through tomorrow morning. Storm total rainfall
amounts 1.5 to 3.0 inches possible, with locally higher amounts
approaching 4.0 inches near TN River Valley Region. One concern
associated with tropical weather systems is likelihood for heavy
showers training over the same area. Heavy rainfall can accumulate
quickly and lead to possible flash flooding across these areas.
Locations that have received saturating rainfall amounts over the
previous few days could also be more prone to flash flooding.

TNZ005>011-023>034-056>066-075-077>080-093>095-301200-
/O.CON.KOHX.FF.A.0001.000000T0000Z-180530T1200Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
Stewart-Montgomery-Robertson-Sumner-Macon-Clay-Pickett-Houston-
Humphreys-Dickson-Cheatham-Davidson-Wilson-Trousdale-Smith-
Jackson-Putnam-Overton-Fentress-Perry-Hickman-Lewis-Williamson-
Maury-Marshall-Rutherford-Cannon-De Kalb-White-Cumberland-Bedford-
Coffee-Warren-Grundy-Van Buren-Wayne-Lawrence-Giles-
Including the cities of Dover, Clarksville, Springfield,
Hendersonville, Gallatin, Goodlettsville, Lafayette, Celina,
Byrdstown, Erin, Waverly, New Johnsonville, McEwen, Dickson,
Ashland City, Kingston Springs, Nashville, Lebanon, Mount Juliet,
Hartsville, Carthage, South Carthage, Gordonsville, Gainesboro,
Cookeville, Livingston, Jamestown, Allardt, Linden, Lobelville,
Centerville, Hohenwald, Franklin, Brentwood, Columbia, Lewisburg,
Murfreesboro, Smyrna, La Vergne, Woodbury, Smithville, Sparta,
Crossville, Shelbyville, Tullahoma, Manchester, McMinnville,
Altamont, Coalmont, Spencer, Clifton, Waynesboro, Lawrenceburg,
and Pulaski
355 PM CDT Tue May 29 2018

...FLASH FLOOD WATCH REMAINS IN EFFECT THROUGH WEDNESDAY
MORNING...

The Flash Flood Watch continues for

* A portion of Middle Tennessee, including the following areas,
  Bedford, Cannon, Cheatham, Clay, Coffee, Cumberland, Davidson,
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8/21/2018
   De Kalb, Dickson, Fentress, Giles, Grundy, Hickman, Houston,
   Humphreys, Jackson, Lawrence, Lewis, Macon, Marshall, Maury,
   Montgomery, Overton, Perry, Pickett, Putnam, Robertson,
   Rutherford, Smith, Stewart, Sumner, Trousdale, Van Buren,
   Warren, Wayne, White, Williamson, and Wilson.

* Through Wednesday morning

* Average rainfall amounts of one to three inches, with locally
  higher amounts approaching four inches.

* Some flash flooding is possible. In addition, you can expect
  rises to occur on area creeks and streams, and possibly along
  larger rivers as well.

PRECAUTIONARY/PREPAREDNESS ACTIONS...
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WGUS64 KOHX 281707
FFAOHX

URGENT - IMMEDIATE BROADCAST REQUESTED
Flood Watch
National Weather Service Nashville TN
1207 PM CDT Thu Jun 28 2018

...Heavy Thunderstorm Rains May Produce Flash Flooding Today...

.Several episodes of heavy thunderstorm rains are expected this
afternoon over southern and western parts of Middle Tennessee,
producing the potential for rain totals of 3 to 5 inches and
localized flash flooding.

TNZ023>025-056>061-075-077-093>095-290000-
/O.NEW.KOHX.FF.A.0002.180628T1707Z-180629T0000Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
Houston-Humphreys-Dickson-Perry-Hickman-Lewis-Williamson-Maury-
Marshall-Bedford-Coffee-Wayne-Lawrence-Giles-
Including the cities of Erin, Waverly, New Johnsonville, McEwen,
Dickson, Linden, Lobelville, Centerville, Hohenwald, Franklin,
Brentwood, Columbia, Lewisburg, Shelbyville, Tullahoma,
Manchester, Clifton, Waynesboro, Lawrenceburg, and Pulaski
1207 PM CDT Thu Jun 28 2018

...FLASH FLOOD WATCH IN EFFECT UNTIL 7 PM CDT THIS EVENING...

The National Weather Service in Nashville has issued a

* Flash Flood Watch for a portion of Middle Tennessee, including
  the following areas, Bedford, Coffee, Dickson, Giles, Hickman,
  Houston, Humphreys, Lawrence, Lewis, Marshall, Maury, Perry,
  Wayne, and Williamson.

* Until 7 PM CDT this evening

* Several periods of heavy thunderstorm rains with potential
  totals of 3 to 5 inches.

PRECAUTIONARY/PREPAREDNESS ACTIONS...
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/21/2018

A Flash Flood Watch means that conditions may develop that lead
to flash flooding. Flash flooding is a very dangerous situation.

You should monitor later forecasts and be prepared to take action
should Flash Flood Warnings be issued.

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Flash Flood Warning - Standard

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WGUS55 KBOU 250327
FFWBOU
COC087-250600-
/O.NEW.KBOU.FF.W.0011.180725T0327Z-180725T0600Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/

BULLETIN - EAS ACTIVATION REQUESTED
Flash Flood Warning
National Weather Service Denver CO
927 PM MDT TUE JUL 24 2018

The National Weather Service in Denver Colorado has issued a

* Flash Flood Warning for...
  North central Morgan County in northeastern Colorado...

* Until midnight MDT.

* At 926 PM MDT, Doppler radar indicated thunderstorms produ
  very heavy rain over Fort Morgan. The rain is moving south
  mph. Up to three inches of rain have already fallen north
  Morgan. The town of Fort Morgan may see rainfall rates of
  to 2 inches in 30 minutes. Flash flooding is expected to b

  HAZARD...Flash flooding caused by heavy rain.

  SOURCE...Radar rainfall estimates.

  IMPACT...Flash flooding of small creeks and streams, highways and underpasses.

* Some locations that will experience flooding include...
  Fort Morgan and Log Lane Village.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Be especially cautious at night when it is harder to recognize the
dangers of flooding.

&&

LAT...LON 4046 10398 4048 10378 4023 10378 4030 10389

FLASH FLOOD...RADAR INDICATED
EXPECTED RAINFALL...2 INCHES IN 30 MINUTES
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HAZARD...Flash flooding caused by heavy rain.

SOURCE...Radar rainfall estimates.

IMPACT...Flash flooding of small creeks and streams, highways and underpasses.

No Flash Flood Damage Threat tag

Flash Flood Warning - Considerable

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WGUS52 KMHX 150702
FFWMHX
NCC013-049-103-107-151000-
/O.NEW.KMHX.FF.W.0017.180915T0702Z-180915T1000Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/

BULLETIN - EAS ACTIVATION REQUESTED
Flash Flood Warning
National Weather Service Newport/Morehead City NC
302 AM EDT SAT SEP 15 2018

The National Weather Service in Newport has issu

* Flash Flood Warning for...
  Northeastern Jones County in eastern North Car
  Northern Lenoir County in eastern North Caroli
  Craven County in eastern North Carolina...
  Southwestern Beaufort County in eastern North

* Until 600 AM EDT.

* At 254 AM EDT, emergency management reported f
  rain bands associated with Tropical Storm Flor
  inches of rain have fallen since Thursday, and
  4 inches are possible across the warned area o

* HAZARD...Flash flooding caused by heavy

* SOURCE...Emergency management.

* IMPACT...Life-threatening flash flooding of creeks and
  streams, urban areas, highways, streets, and underpasses.

* Some locations that will experience flooding include...
  New Bern, Kinston, La Grange, River Bend, Grifton, Blounts Creek,
  Vanceboro, Askins, Cayton, Fort Barnwell, Jasper, Tuscarora,
  Dawson, Rhems, Wilmar, Edward, Graingers, Institute, Cox Crossroads
  and Wyse Fork.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Turn around, don't drown when encountering flooded roads. Most flood
deaths occur in vehicles.

Be especially cautious at night when it is harder to recognize the
dangers of flooding.

&&

LAT...LON 3537 7780 3538 7770 3535 7767 3543 7748
      3535 7743 3533 7738 3533 7735 3538 7729
      3535 7725 3539 7724 3542 7719 3553 7716

FLASH FLOOD...OBSERVED

FLASH FLOOD DAMAGE THREAT...CONSIDERABLE
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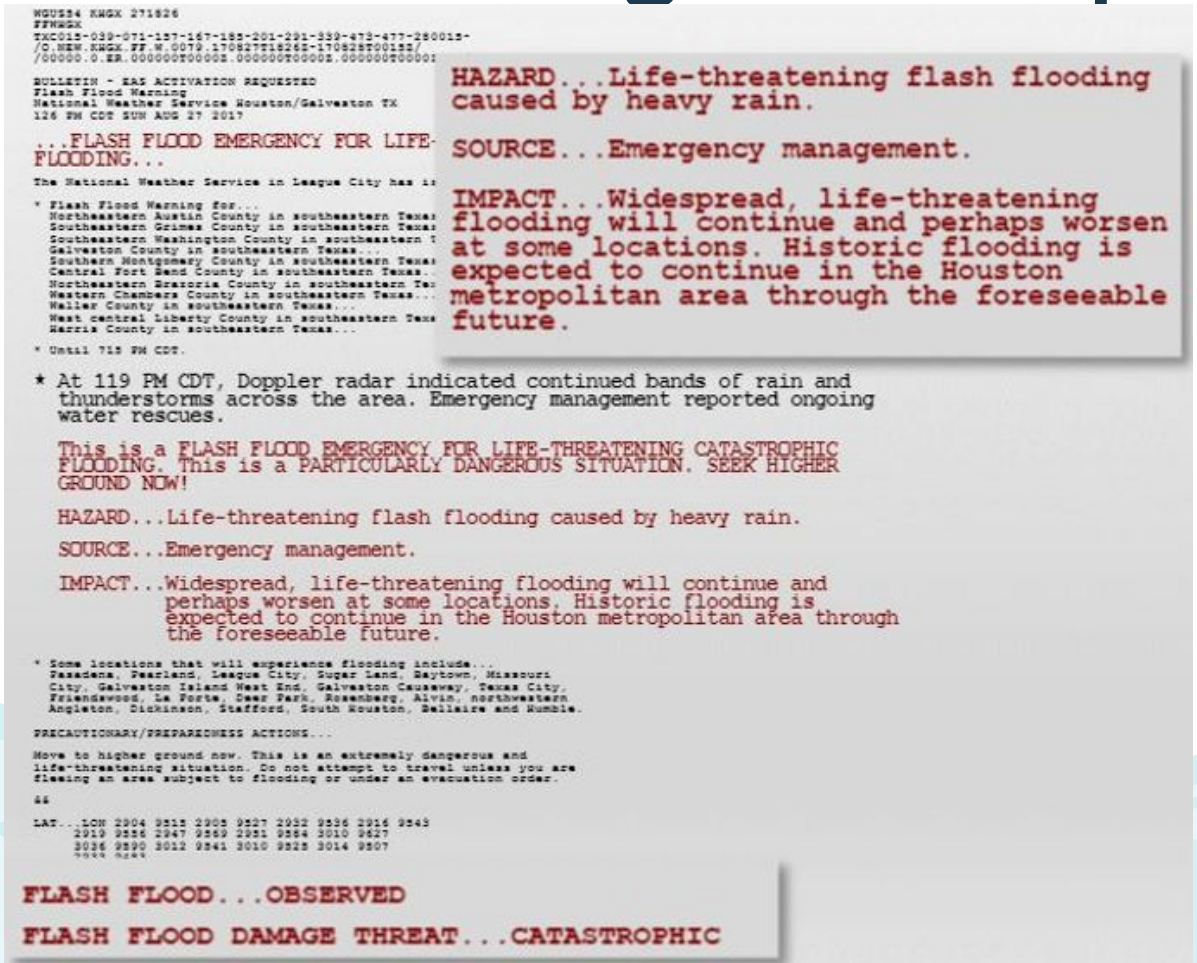
HAZARD...Flash flooding caused by heavy rain.

SOURCE...Emergency management.

IMPACT...Life-threatening flash flooding of creeks and streams, urban areas, highways, streets, and underpasses.

Flash Flood Warning - Catastrophic



WGUS54 KHGX 271826
FFWHGX
TXC015-039-071-157-167-185-201-291-339-473-477-480015-
/O.NEW.KHGX.FF.W.0079.170827T1826Z-170828T0015Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z/

BULLETIN - EAS ACTIVATION REQUESTED
Flash Flood Warning
National Weather Service Houston/Galveston TX
126 PM CDT SUN AUG 27 2017

...FLASH FLOOD EMERGENCY FOR LIFE-
FLOODING...

The National Weather Service in League City has i

* Flash Flood Warning for...
  Northeastern Austin County in southeastern Texa
  Southeastern Grimes County in southeastern Texa
  Southeastern Washington County in southeastern T
  Galveston County in southeastern Texas...
  Southern Montgomery County in southeastern Texa
  Central Fort Bend County in southeastern Texas...
  Northeastern Brazoria County in southeastern Te
  Western Chambers County in southeastern Texas...
  Waller County in southeastern Texas...
  West central Liberty County in southeastern Texa
  Harris County in southeastern Texas...

* Until 715 PM CDT.

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency management.

IMPACT...Widespread, life-threatening flooding will continue and perhaps worsen at some locations. Historic flooding is expected to continue in the Houston metropolitan area through the foreseeable future.

* At 119 PM CDT, Doppler radar indicated continued bands of rain and thunderstorms across the area. Emergency management reported ongoing water rescues.

This is a FLASH FLOOD EMERGENCY FOR LIFE-THREATENING CATASTROPHIC FLOODING. This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency management.

IMPACT...Widespread, life-threatening flooding will continue and perhaps worsen at some locations. Historic flooding is expected to continue in the Houston metropolitan area through the foreseeable future.

* Some locations that will experience flooding include...
  Pasadena, Pearland, League City, Sugar Land, Baytown, Missouri City, Galveston Island West End, Galveston Causeway, Texas City, Friendswood, La Porte, Deer Park, Rosenberg, Alvin, northwestern Angleton, Dickinson, Stafford, South Houston, Bellaire and Humble.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Move to higher ground now. This is an extremely dangerous and life-threatening situation. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order.

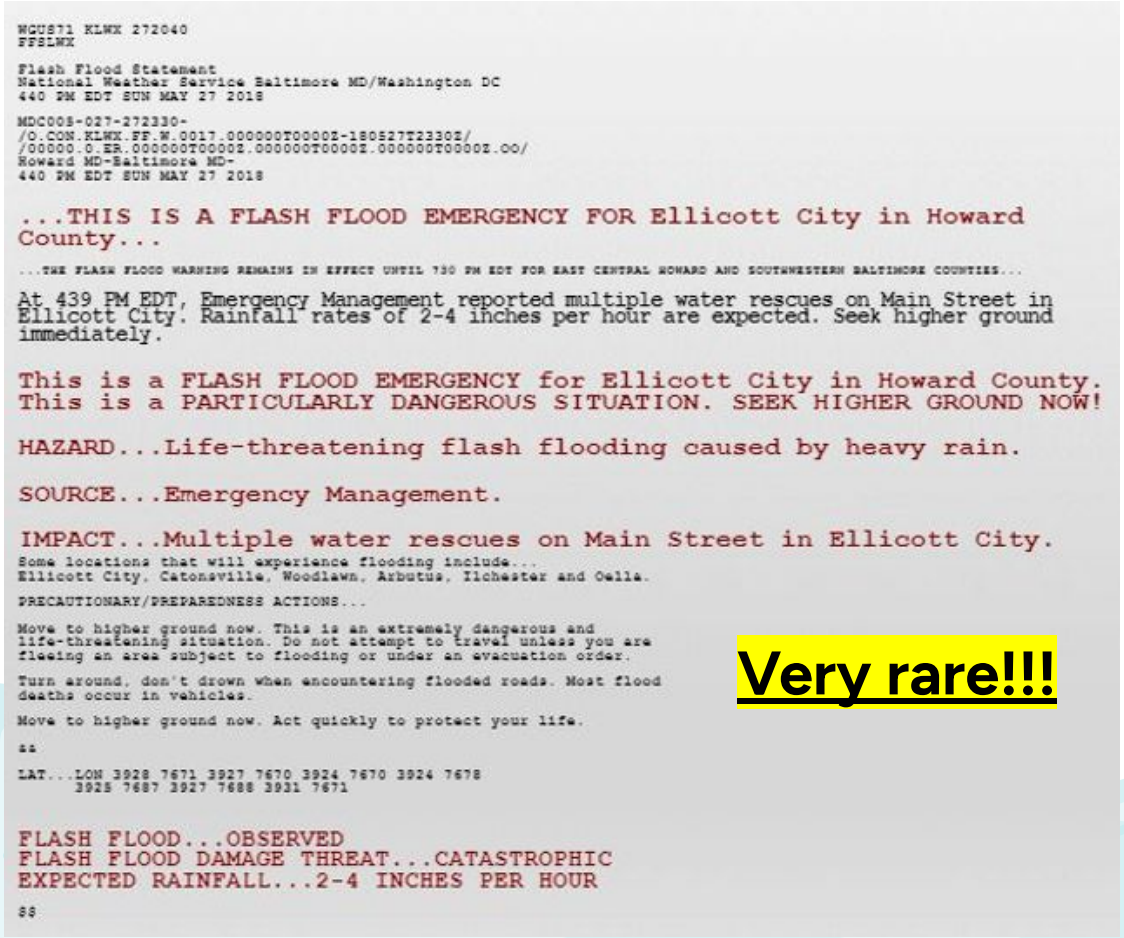
&&

LAT...LON 2904 9515 2905 9527 2932 9536 2916 9543
      2919 9556 2947 9569 2951 9584 3010 9627
      3036 9590 3012 9541 3010 9525 3014 9507
      [illegible]

FLASH FLOOD...OBSERVED

FLASH FLOOD DAMAGE THREAT...CATASTROPHIC

Flash Flood Emergency



WGUS71 KLWX 272040
FFSLWX

Flash Flood Statement
National Weather Service Baltimore MD/Washington DC
440 PM EDT SUN MAY 27 2018

MDC005-027-272330-
/O.CON.KLWX.FF.W.0017.000000T0000Z-180527T2330Z/
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
Howard MD-Baltimore MD-
440 PM EDT SUN MAY 27 2018

...THIS IS A FLASH FLOOD EMERGENCY FOR Ellicott City in Howard County...

...THE FLASH FLOOD WARNING REMAINS IN EFFECT UNTIL 730 PM EDT FOR EAST CENTRAL HOWARD AND SOUTHWESTERN BALTIMORE COUNTIES...

At 439 PM EDT, Emergency Management reported multiple water rescues on Main Street in Ellicott City. Rainfall rates of 2-4 inches per hour are expected. Seek higher ground immediately.

This is a FLASH FLOOD EMERGENCY for Ellicott City in Howard County.
This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency Management.

IMPACT...Multiple water rescues on Main Street in Ellicott City.

Some locations that will experience flooding include...
Ellicott City, Catonsville, Woodlawn, Arbutus, Ilchester and Oella.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Move to higher ground now. This is an extremely dangerous and life-threatening situation. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order.

Turn around, don't drown when encountering flooded roads. Most flood deaths occur in vehicles.

Move to higher ground now. Act quickly to protect your life.

&&

LAT...LON 3928 7671 3927 7670 3924 7670 3924 7678
3925 7687 3927 7688 3931 7671

FLASH FLOOD...OBSERVED
FLASH FLOOD DAMAGE THREAT...CATASTROPHIC
EXPECTED RAINFALL...2-4 INCHES PER HOUR

&&

Very rare!!!

River Flood Warning

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WGUS44 KOHX 070604
FLWOHX
Bulletin - Immediate Broadcast Requested
Flood Warning
National Weather Service Nashville TN
1204 AM CST Tue Nov 7 2017

...The National Weather Service in Nashville, Tn has issued a flood warning for
the following rivers in middle Tennessee...

  Richland Creek At Belle Meade Near Harding Place AFFECTING Davidson County

.Thunderstorms with heavy rain have caused creek in southern Davidson County to
rise above flood stage.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Avoid flooded areas along the river...And move personal belongings to higher
ground. Never drive through flooded roads as the depth of water may be too great
to pass...Even in trucks or sport utility vehicles. If you come across a flooded
road...Turn around don't drown.

Stay tuned to noaa weather radio or other local media for further information
from the National Weather Service.

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TNC037-071804-
/O.NEW.KOHX.FL.W.0017.171107T0604Z-000000T0000Z/
/BMDT1.2.ER.171107T0511Z.171107T0545Z.000000T0000Z.UU/
1204 AM CST Tue Nov 7 2017

The National Weather Service in Nashville, Tn has issued a

* Flood Warning for
  The Richland Creek At Belle Meade Near Harding Place
* From early this morning until further notice.
* At 11PM Monday the stage was...10.0 feet
* Flood stage is 7.0 feet.
* The river will rise to near 11.0 feet then begin falling.
* At 11.0 feet...The parking lot of Belle Meade Terrace condominiums begins to
  flood.
* At 10.0 feet...The parking area near the creek and Harding Place begins to be
  flooded.

&&

LAT...LON  3606 8690 3617 8689 3616 8683 3606 8680

$$

Shamburger
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Flood Advisory

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WGUS84 KOHX 070426
FLSOHX

Flood Advisory
National Weather Service Nashville TN
1026 PM CST MON NOV 6 2017

TNC021-037-043-187-070630-
/O.NEW.KOHX.FA.Y.0091.171107T0426Z-171107T0630Z/
/00000.N.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
Davidson TN-Dickson TN-Williamson TN-Cheatham TN-
1026 PM CST MON NOV 6 2017

The National Weather Service in Nashville has issued a

* Flood Advisory for...
  Southern Davidson County in Middle Tennessee...
  Southern Dickson County in Middle Tennessee...
  Northern Williamson County in Middle Tennessee...
  South central Cheatham County in Middle Tennessee...

* Until 1230 AM CST

* At 1025 PM CST, Doppler radar indicated heavy rain due to
  thunderstorms continuing to move across the area. Radar estimates
  up to 2 inches of rain has fallen in the past hour from Dickson to
  Kingston Springs to Brentwood. This will cause minor flooding in
  the advisory area.

* Some locations that will experience flooding include...
  Franklin, Dickson, Brentwood, Nolensville, Forest Hills, Oak Hill,
  White Bluff, Belle Meade, Kingston Springs, Pegram, Burns,
  Bellevue, Antioch, Fairview, Charlotte, Berry Hill, Bells Bend and
  Natchez Trace At Highway 96.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Be especially cautious at night when it is harder to recognize the
dangers of flooding.

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Urban and Small Stream

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Flood Advisory
National Weather Service Nashville TN
559 PM CDT FRI AUG 17 2018

TNC061-180200-
/O.NEW.KOHX.FA.Y.0103.180817T2259Z-180818T0200Z/
/00000.N.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
Grundy TN-
559 PM CDT FRI AUG 17 2018

The National Weather Service in Nashville has issued a

* Urban and Small Stream Flood Advisory for...
  Central and Southeastern Grundy County in Middle Tennessee...

* Until 900 PM CDT.

* At 559 PM CDT, Doppler radar indicated heavy rain due to
  thunderstorms continuing to move into the county. This will cause
  urban and small stream flooding in the advisory area. Doppler
  radar estimates up to locally two inches of rain have already
  fallen. The potential of up to another two inches of rainfall
  falling in isolated locations across central and southeastern
  portions of Grundy County that have already received rainfall as
  the afternoon hours have progressed.

* Some locations that will experience flooding include...
  Gruetli-Laager, Tracy City, Monteagle, Coalmont, Palmer, Pelham and
  Fiery Gizzard State Park.

This includes Interstate 24 between mile markers 128 and 134.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

In hilly terrain there are hundreds of low water crossings which are
potentially dangerous in heavy rain. Do not attempt to cross flooded
roads. Find an alternate route.

A Flood Advisory means river or stream flows are elevated, or ponding
of water in urban or other areas is occurring or is imminent.

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LAT...LON 3524 8582 3523 8588 3524 8588 3530 8590
      3549 8554 3543 8554 3540 8549 3536 8551
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Hydrology VTEC Sheet

Hydrologic Product	Type	Required Application	Phenomena Code	Significance Code	Segmented
Areal Flood Watch	FFA	GFE/GHG	FA	A	Y
Flood Watch (Flash Flooding)	FFA	GFE/GHG	FF	A	Y
Forecast Point Flood Watch	FFA	RiverPro	FL	A	Y
Flash Flood Warning	FFW	WarnGen	FF	W	N
Flash Flood Statement	FFS	WarnGen	FF	W	Y
Forecast Point Flood Warning	FLW	RiverPro	FL	W	Y
Areal Flood Warning	FLW	WarnGen	FA	W	Y
Flood Statement to follow up a Forecast Point Flood Warning	FLS	RiverPro	FL	W	Y
Flood Statement to follow up an Areal Flood Warning	FLS	WarnGen	FA	W	Y
Flood Advisory for Urban and/or Small Stream Flooding	FLS	WarnGen	FA	Y	Y
Flood Advisory (General)	FLS	WarnGen	FA	Y	Y
Forecast Point Flood Advisory	FLS	RiverPro	FL	Y	Y
Hydrologic Outlook	ESF	GFE	None	None	N
Hydrologic Statement	RVS	RiverPro	None	None	N
Hydrologic Summary	RVA	RiverPro	None	None	N
River and Lake Forecast Product	RVD	RiverPro	None	None	N

06

Conclusion

Flooding is DANGEROUS

Thank you!

Do you have any questions?

Email: paige.baggett@noaa.gov
Office Phone: (615) 754-8500
Website: weather.gov/ohx

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